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ABSTRACT

The recent release of the National Science Education Standards and the previous release of Benchmarks for Scientific Literacy have initiated science education reform at the state, district, and local school levels. The purpose of this study was to investigate the extent to which a group of science teachers, administrators, and a curriculum supervisor in a small rural school district would incorporate national and state science education standards into their science curriculum adoption criteria. The 14 participants were involved in 2 one-day inservice workshops which brought together science representatives from the different school levels in the county. Data sources included a survey, personal interviews, field notes from the workshops and meetings with the curriculum supervisor, and documents. Findings indicate that the teachers were isolated and had not heard of the new national and state standards which were considered up-to-date. The teachers also complained about the lack of materials and funding to obtain them. Results also indicate that the teachers did not know much about the science teaching ideas found in the national and state documents--ideas such as cooperative learning, inquiry-based science lessons, and performance assessment. Implications for science teacher education are discussed. Appendix includes the science textbook evaluation criteria. Contains 35 references. (JRH)

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SCIENCE EDUCATION REFORM IN A RURAL COUNTY

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ED 405 186

Introduction

The recent release of the *National Science Education Standards* (NSES) (National Council of Research, 1996) and the previous release of *Benchmarks for Scientific Literacy* have initiated science education reform at the state, district and local school levels. Rural counties are often the last counties to receive information on current trends in science education reform and curriculum reform (Easton & King, 1991). Sometimes small rural school districts are not up-to-date on national or state trends in science educational standards (Prather & Hartshorn, 1989). School districts and teachers within those districts have been under pressure to adopt and implement processes of reform that would align their practice with national standards (Hurd, 1986).

Although there have been studies on the relevancy of curriculum to rural schools (Nash, 1980; and Anand, 1988), there have not been many studies done concerning the influence of national standards on rural school districts and teachers (Matthew, 1995). Nash (1980) and Anand (1988) stated that the content of science classes in the rural classrooms was irrelevant to the needs of the people living in the rural communities because most of the science curriculum had its origins with urban and suburban concerns and needs. Matthew (1995) stated:

> *Project 2061: Science Education for All Americans* outlined a national curriculum which could be used in all schools, urban and rural. The outline of Project 2061 was broad enough to allow rural teachers the freedom to explore areas relevant to their students and their unique situation (p. 32).

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Welch and Wagner (1989) stated:

> Recent pressures on rural schools, for example, changes in enrollment patterns and erosion of their economic support base due to declines in the value of farm land, have sensitized policy makers to the need to better understand the condition of rural education across the nation (p. 1).

Easton and King (1991) raised the question: "How might rural teachers such as these be better connected with the current knowledge, teaching methods, curriculum materials, and curriculum organization that are disseminated through state, regional, and national conferences on science or social studies education?(p. 37)" This paper focused on the degree to which a group of science educators in a rural school district implemented ideas found in national and state standards in the development of a science curriculum adoption criteria list.

The US Census bureau defined rural as "a residual category of places outside urbanized areas in open country, or in communities with less than 2,500 inhabitants, or where the population density is less than 1,000 inhabitants per square mile (p.4)." Horn (1995) provided insight into what constituted a rural school. Rural schools were defined based upon location, population, economic influences, and remoteness. Stern (1995) defined rural with two elements; sparse populations and distance from urban centers. There has been no consensus on the definition of rural. For the purpose of this paper, the researchers described rural as a small community in a county an hour away from a large populous metropolitan area. The area was characterized by farming and a population of low income residents not in government supported housing. The two largest towns in the county had their own school districts. The rest of the county had a school district which served the "non-town" people or more rural people. The county school system

consisted of five Pre-K through fifth grade elementary schools, two sixth through eighth grade middle schools and one high school. The system served 4400 students. This study took place in the school district which served the "non-town" community.

A study of the influence of national and state standards on the local science curriculum adoption committee was warranted because one-fourth of the school population was rural (Batey and Hart-Landsberg, 1993), and the national standards promoted universal themes, such as; "science for all," constructivism, integrated science, and "less is more." The *Georgia Initiative in Mathematics and Science* (GIMS), a state-wide systemic initiative, involved science and mathematics teachers, scientists and mathematicians, science and mathematics educators, state department of education personnel, and industrial and business leaders. The *Learning Framework* within GIMS provided a vision for science and mathematics teaching and learning in Georgia's schools which was compatible with and complementary to the wider national vision for science education as described in the Benchmarks and NSES. In brief, the *Georgia Framework for Learning Mathematics and Science* "communicates the knowledge, skills, and dispositions in science and mathematics necessary for all Georgia students." It was useful for guiding local curriculum development efforts and redirecting instructional practices and assessment strategies. Another of the *Framework's* uses was to inform reform decisions about the appropriateness of curriculum materials to be used in science and mathematics at local levels.

Anderson et. al (1993) indicated that one theme found in a literature search about science reform was constructivism. They explained that effective learning required focusing on the most important concepts so that conceptual understanding was fostered. Prather (1995) promoted the idea of an integrated curriculum expressed in the national documents. He described this idea as

not new, rather rural teachers have been integrating science with other disciplines and real life for many years. Hurd (1991) indicated that teaching science in the traditional subject specific manner misrepresented the nature of science. An integrated approach would make science more relevant and meaningful to the students.

Implementation and improvement meant change, and change was not always accepted in rural schools. Anderson et. al. (1993) determined some barriers to change: 1) beliefs and values of the teachers, administrators, community, and reformers (the more diverse the beliefs and values, the more difficult it was for reform to occur), 2) consensus regarding the means for reaching their new vision of education, 3) student expectations, and, 4) other institutional and cultural constraints (bureaucracies, limited budgets, assessment practices and rigid regulations). These barriers were based upon knowledge of the universal themes of national reform documents and the power relationships within school districts. Killian and Byrd (1988) stated that improvement in science education was at an advantage in the rural schools, because the momentum for change and improvement was mostly initiated by the teachers rather than the curriculum coordinators or principals.

Mann, Price, and Kellogg (1993) discussed the importance of the input from rural science teachers on science reform. "For a reform program to be implemented successfully in the science curriculum, the reform program must have the support of the teachers whose lives and careers will be impacted by the project (p. 4)." The authors mentioned that if any efforts in reform were to occur, that the reform had to focus upon the science teachers and include significant input from them for improving instruction and student performance. "This need for securing input from teachers prior to proposing changes in their curriculum is particularly important for projects that

involve rural schools (p. 4)." Enochs (1988) found that "planning must be broad-based, technical assistance for implementation must be available to teachers, and change must be supported at the institutional level (p. 5)."

Nachtigal (1982) stated that a community in transition would be a battleground for priorities in curriculum, political structure, locus of control, and values represented. Pelton (1983) stated that rural/small schools could do a better job of school improvement and reform because rural teachers were closer to the "seats of power" than in nonrural schools. Sher (1977) stated that "among the needs in this area (curriculum), highest priority must be given to the development of competently designed curricula that are appropriate to the communities in which they will be utilized (p. 285)." Loucks and Melle (1981) described a district-wide reform of the science curriculum in grades 3-6. An insight gained from the study was that the least successfully implemented components of the reform curriculum were those mandated by the district, or those lacking ownership by the teachers.

Purpose

The purpose of this study was to investigate the extent to which a group of science teachers, administrators, and a curriculum supervisor in a small rural school district would incorporate national and state science education standards into their science curriculum adoption criteria. The 14 participants were involved in two one-day inservice workshops which brought together science representatives from the different school levels in the county. The agenda for the workshops included opportunities for the participants to learn about national and state science standards, and, based upon that learning, develop a criteria selection list that would eventually be used when choosing new science curriculum materials for the school system. The science materials selection

process occurred once every seven years. The two researchers were tasked with the responsibility of presenting the national and state standards and were to act as consultants during the two inservice workshops. The researchers made two assumptions prior to presenting the standards during the first of the workshops:

1) The prior knowledge of the committee members concerning the national and state standards would be slight.

2) The committee members would not accommodate the standards in their construction of a science curriculum "materials selection criteria"

Based upon the events of the first workshop, responses to a survey, and meetings with the district curriculum supervisor, two more assumptions were made:

1) The committee would not have much power to incorporate their understanding of the standards into the science curriculum "materials selection criteria"

2) The district curriculum supervisor would have most of the power to decide which issues would be considered relevant to the curriculum adoption process.

Methods.

Theoretical framework. Anderson and others (1993) suggested that a study of curriculum reform be based upon multiple perspectives because of the complexity of curriculum reform efforts. Their study focused on critical events that embodied or illustrated "the reform effort whether successful or unsuccessful (p. 1)." Two perspectives were used for this study, post-positivism and critical theory. Together, these theoretical frameworks allowed the researchers to collect data from a particular frame of reference, ask particular questions appropriate to the research assumptions, and interpret the data.

The postpositivist framework stemmed from an understanding that socially mediated occurrences had multiple meanings, and that the interpretation of such occurrences were subjective. Objective reality and observations were limited to each participant and researcher. Each person developed meaning as it related to him/her. Constructivism was one aspect of the postpositivist movement which the researchers used to explore the multiple realities and meanings for the many participants.

Science educators also have become aware of the external or hidden forces which might direct a workshop. Critical theory provided the opportunity to study the adoption process, because it also provided a means by which we asked the question, Whose values have determined the criteria for adoption? Postpositivism and critical theory serve as the theoretical frameworks for examining the extent to which the participants incorporated national and state standards into the "materials selection criteria."

Postpositivism (Constructivism). A constructivist epistemology (Vygotsky, 1978) was used in the conceptualization and the collection and analysis of data for this project. Constructivism realized that individuals come into a setting with prior knowledge, and that learning occurred either through assimilating the new information with existing knowledge structures or through accommodating the new information by creating new knowledge structures. The participants in this study were able to create an environment and conditions which best allowed them to construct new knowledge independently through social interaction. The constructivist view of learning challenged the traditional transmission model of learning which focused on the instructor as a transformer of subject matter. In order for information to be learned and understood, it was to be actively transformed by the process of learning.

The participants in this study were learners as well as teachers. As learners they came to understand the processes of selection and adoption. As teachers they were able to instruct their colleagues on the processes involved. Padilla described a teacher as one who "realizes that knowledge cannot simply be transmitted to others, no matter how good that transmission is (1991). The teachers and administrators involved with this committee went through the process of constructing their own operational definition and understanding of reform, and what reform, standards, and science curriculum meant to each of them and their school and teaching.

Critical theory. Critical theory has been described under the broad heading of social transformation theory. This theory stated that there must be empowerment, voice and emancipation when a culture was transformed. A culture was transformed when it was disrupted and challenged the status quo. The culture in this study was the science curriculum committee in a rural county, and the process the committee underwent to determine a selection criteria was the disruption. Giroux (1988) stated that schools or programs could become liberating when forms of knowledge and social relations were taught for the purposes of educating people for critical empowerment. To understand critical theory, one had to be concerned with the need to raise people's awareness about how the hegemony shapes them. The research in this paper was based upon one out of seven assumptions made by Kincheloe and McLaren (1994): that power relations are socially and historically constituted.

The researchers drew upon critical social theory to help them employ their understanding of the participants' roles in the selection and adoption processes. Social theory allowed the participants to transform their situation in the spirit of empowerment. Did the opportunity to decide really begin with the participants, or was the strongest voice that of the hegemony? The

research became transformative when the participants viewed the processes of criteria selection and curriculum adoption as potentially emancipating and liberating. Critical theory was one lens through which the researchers examined the processes of selection and adoption of a representative group of educators in a rural county.

Participants. The participants for this study were six elementary school teachers, two middle school science teachers, two high school science teachers, three administrators (one from each school level), a district curriculum supervisor, and two consultants. All of the participants were volunteers and expressed a strong interest in science and curriculum reform. They were paid a stipend and given professional credit hours.

The researchers were hired as consultants to facilitate "science leadership in schools, follow-up data collection, and development of selection criteria." The researchers provided instruction on the *National Science Education Standards*, the *Benchmarks for Scientific Literacy*, and the *GIMS Learning* Framework. The researchers also developed a survey to determine the extent of knowledge of national and state standards, determine the use of different types of teaching materials in the science classes, determine the level of use of various teaching methods and teaching techniques, and survey issues and concerns teachers had about science teaching. The survey was disseminated system-wide as well as to the workshop participants prior to the first workshop. Survey results were compiled and analyzed, and then reported to the committee members during the first workshop.

Context of the study. Three of the five elementary school principals indicated that science was one of the three most important subjects. The two middle schools employed a total of five science teachers who taught approximately 55% of the science classes. The other 45% of the

science classes in the middle schools were taught by veteran teachers who had not majored in a science discipline and who had been originally hired to teach subjects other than science. The high school science department consisted of three science teachers all of whom had majors in various science disciplines. The curriculum supervisor for the school system had a strong elementary science background and a Ph.D. in education administration. Iowa Test of Basic Skills test scores showed that the school system scored above the state average in science with an average score of 520 within a range from 400 to 600. Curriculum Based Assessment (CBA) test scores showed that the school system scored below the state goal in science with an average score of 165. The state goal is 168.

The researchers met with the district curriculum supervisor three times prior to the workshops to discuss the content and format of the workshops. The curriculum supervisor made all final decisions on the agenda for both workshops. The workshops were conducted in the school system's district headquarters for a total period of ten hours over two Saturdays. The amount of time allotted for the *National Science Education Standards*, the *Benchmarks for Scientific Literacy*, and the *GIMS Learning Framework* totaled two hours during the first workshop. The amount of time allotted for discussion of the "materials selection criteria" totaled two hours during the second workshop. The rest of the time was dedicated to: teaching a rocks-and-minerals lesson to illustrate various concepts contained in NSES and GIMS; discussion of various science curriculum-related issues including follow-up agenda for a meeting of the committee in the spring; availability and allocation of funding for science during the next school year; motivational exercises conducted by the curriculum supervisor; and creation of a rough draft of a science "materials selection criteria" which would be massaged into a smooth draft by the curriculum supervisor for approval by the committee.

Procedure

Nature of the study. An interpretive research approach was used to examine how national and state standards were understood and incorporated into the science curriculum "materials selection criteria" (Gallagher, 1991). Interpretive research provided a tool to better understand social phenomena in the science milieu. "The intent is to understand, in depth, teachers' actions and the knowledge, beliefs and values that lie behind them" (Gallagher, 1991).

Critical researchers maintained that the meaning of an experience was not self-evident. The interpretation of an experience depended upon the definition of the experience by the researchers (Giroux, 1988). Critical interpretation did not follow the empiricist tradition that posited data as irrefutable facts. Kincheloe (1991) stated that the facts "represent hidden assumptions-assumptions the critical researcher must dig out and expose. What we call information always involves an act of human judgment. From a critical perspective this act of judgment is an interpretive act."

A case study approach was used because the committee met twice, had a clear objective, and was composed of different teachers bringing diverse opinions, experience, and knowledge into the setting (Stake, 1995). Anderson et. al (1993) gave four criteria in which a case study of educational reform could take place: 1) all students learn to think; 2) teachers use the constructivist conceptions in their teaching; 3) the approach to curriculum is "less is more;" and 4) major attempts are made to focus on themes and concepts and integration across disciplines, rather than facts. The last three criteria for reform were reflected in this study. An important aspect of an interpretive research approach is to build theory from knowledge acquired with one set of data, and incorporate it as a base for gathering

the next set of data (Tobin & Tippins, 1993). Based upon the analysis of data collected during the first workshop, meetings with the curriculum supervisor, and responses to a survey, new assumptions were formed prior to the start of the second workshop.

Data Collection. Data sources included the following: 1) a survey; 2) personal interviews; 3) field notes from the workshops and meetings with the curriculum supervisor; and 4) documents submitted to and produced by the committee. An initial survey was produced to determine the range of knowledge concerning standards, curricular materials, and affective components related to the teaching of science. "Grand tour" and "mini tour" questions were used in the interviews (Spradley, 1979). All data collection was based upon the assumptions made by the researchers.

Data Analysis. The survey was analyzed by finding the means of a five point Likert scale to determine the range of knowledge for a particular question. Open-ended questions, interviews and field notes were coded with respect to the assumptions to find any agreement or disagreement with the assumptions made by the researchers. The data was coded using etic and emic categories. The categories were defined in relationship to the research assumptions.

Findings

Phase 1. **The prior knowledge concerning the national and state standards would be slight.**

At the beginning of the first workshop, the participants were asked to raise their hands if they were familiar with the *Georgia Initiative for Mathematics and Science* (GIMS), the *National Science Education Standards* (NSES), or *Benchmarks for Scientific Learning*. No one raised their hand. Asked if they had heard of any of these documents, three people raised their hand. A lack of knowledge about NSES and GIMS was due in part to the isolation of the school district,

and its not receiving copies of or learning about standards during inservice training, faculty meetings, or professional conferences. According to comments made by the curriculum supervisor, an assistant-principal-for-instruction, and two of the committee members during initial discussion, NSES and GIMS were known of but not yet available in the school system.

According to the survey response, science teachers in the county school system were somewhat unsure (2.1 on a scale from 1-5) of their knowledge concerning the *National Science Education Standards*. The same group of teachers felt even less confidence (1.5 on a scale of 1-5) in their knowledge of the standards contained in the *Georgia Initiative for Mathematics and Science*. The workshop participants' responses reflected those of the general population.

Prior to GIMS the state had a curriculum guideline called the *Quality Core Curriculum* (QCC). The QCC was a list of instructional objectives that teachers had to teach and students had to learn. The teachers focused on the QCCs because they were expected to teach from them and were evaluated according to the extent that the QCCs were included in their lesson plans. Most of the teachers were more preoccupied and worried about a match between the new curriculum and textbooks and the QCC rather than the new national and state standards. Janet stated that she needed a "textbook that covers the QCCs so that the teacher can add to it instead of building the whole unit herself. John stated that he needed a "text that covers QCC as well as having a wealth of practical hands-on activity suggestions that can be carried out with items commonly found around the home." All participants were more concerned with the current state guidelines (QCC) even though they had been told that the QCC was being phased out and GIMS had already been adopted by the state Department of Education. This concern was reflected by the teachers who had responded to the survey.

The committee members would not accommodate the standards in their construction of a science curriculum "materials selection criteria"

According to the final version of the "material selection criteria" list (See Appendix A), the *National Science Education Standards* and the *Georgia Initiative for Mathematics and Science* were given the same weight as the graduation test and CBA's, that is, they were listed among the "material selection criteria" at the secondary level and were listed simply as "national standards" and "GIMS -- state adopted learning framework" under a primary heading of "Content Alignment." They were to be considered on a scale from one to four with one indicating total disagreement and four indicating total agreement.

The "material selection criteria" contained seven section headings that the school systems' teachers would use to evaluate proposed curriculum materials. Under each section heading were subheadings which described certain aspects that were considered crucial for understanding the headings. No further explanation of the selection criteria was provided.

According to the curriculum supervisor, the "material selection criteria" was purposely designed to minimize the time spent evaluating prospective curricular materials. Beverly, a middle school teacher, stated, "We don't have time to go through a large checklist. We know the content well enough." The curriculum supervisor also stated that "The teachers will need a one page list of criteria."

The "materials selection criteria" may have been vague, but the one-page list of criteria served the committee's purposes.

PHASE 2. In the second phase, it was determined that the person with the most control and knowledge was situated in a position to suggest and ultimately make decisions effecting the

content of the science curriculum "materials selection criteria." The committee had suggestions which were incorporated into the "materials selection criteria," but the philosophy behind the selection process and the final writing of the criteria were that of the district curriculum supervisor.

The committee would not have much power to incorporate their understanding of the standards into the science curriculum "materials selection criteria."

At the beginning of the first workshop, Martha, the curriculum supervisor, used an analogy taken from the Georgia Science Teachers Association (GSTA) to lay the foundation for the work ahead of the committee.

> I'm going to start with something from GSTA, but I'm going to make it fit Olympic County. ROPES is a philosophy that we will use to make everything all encompassing. R is for role; we will not work in isolation, and we will make a kid a contributing citizen. O is for openness, to broaden our framework to science change. P is for participation, everyone will participate. E is for experimentation, it is an attitudinal thing, you are here, so you care. S is for sensitivity, the synergy is if we really going to change for the better, we work together. (Martha, 3/12)

After the introduction the committee members began to discuss the issues and concerns they had mentioned on the survey. The discussion was meant to set the framework for the "materials selection criteria" sections. Even though the curriculum supervisor created a team atmosphere, she dictated the format of the workshops and wrote the "materials selection criteria."

At the beginning of the second day, groups were formed to discuss the standards and criteria that should be included in the "material selection criteria." The main ideas behind the national and

state documents that were discussed were not new to the committee, the ideas were just not necessarily called by the same name or phrase as in the standards. For example, constructivism was not mentioned by name, but the idea that students should learn from experience and develop their own understanding was reflected in the teachers' concerns and what the teachers used to plan their lessons. Jenny stated that most of her material for teaching students to think and learn science were "teacher made from questions, to lab sheets, to study sheets, to tests." Candice stated that "supplementary material, hands-on activities, appropriate for variety of levels and learning styles." These teachers believed that students learn best by learning to think with a myriad of hands-on activities and materials.

Another theme used by the teachers that was also found in the standards was, activities should be hands-on and practical to the local community and child. Debra stated that she wanted more "practical science experiments that satisfactorily develop concepts." Tammy stated that she needed "a wealth of practical hands-on activity suggestions that can be carried out with items commonly found around the home." Mike stated that he "would like to see our schools adopt some sort of environmental/wildlife curriculum." These teachers understood the general ideas of the standards that were presented to them, and voiced there concerns for the implementation of these ideas into the new curriculum. Martha, the curriculum supervisor, agreed with these statements, but directed the committee to think of the standards in general and how Jackson County would be included in everyday science, "Your responsibility is to relate the material to the school and system."

Martha, the curriculum supervisor, allowed the discussion about possible criteria and science teaching ideas to continue for two hours. After the group discussions, the groups shared their

ideas. Martha copied the ideas and suggestions onto a sheet of paper from which she would construct the "materials selection criteria" at a later date. She then set the agenda for the rest of the day. Two hours would be used for the discussion and sharing of criterion ideas. Fifteen minutes would be spent on discussing equipment, budget and inventory concerns. Another fifteen minutes would be spent on pilot reports from three teachers already using some new curriculum. Thirty minutes would be spent on the mission statement for the criteria, thirty minutes on staff development ideas, and thirty minutes on concerns for staff development. The order and sequence of events for the second day dictated the tone of the day and were based upon the ideas of the curriculum supervisor.

The district curriculum supervisor would have most of the power to decide which issues would be considered relevant to the curriculum adoption process.

Part of the survey that was distributed to committee members prior to the workshops asked the teachers what concerns and issues should be addressed by the Science Review Committee. Many of the issues that the teachers wanted to discuss were not raised in the workshop, and many were not mentioned as part of the "materials selection criteria." The high school teachers voiced their concerns about technology and lab equipment. Jason stated, "Teachers are expected to teach recent technology and current issues in science, but they are not provided with adequate lab materials and equipment." In response to the lab equipment, the curriculum supervisor stated that the teachers "should not focus on the materials." Her priority was to match the content curricula with the standards.

The middle school teachers stated their pleasure for technology integration and materials for hands-on activities. Monica stated that she wanted "to be able to use the computer in science

more. I know that there is a lot of great software for science, and I want to be more computer literate to be able to use them." The concern for technology was not a concern at the elementary level, but materials was a major concern for them. Brenda stated that she needed "more hands-on activities and labs that work, and are not babyish." The concerns about technology and materials came from the teachers who were the ultimate ones that would teach the new curricula. The curriculum supervisor agreed that these were legitimate issues, but hesitated to include them in the "materials selection criteria." The curriculum supervisor instructed the teachers to "not worry about the money or the materials; what is important is that we adopt and agree upon the right curricula and supporting items." This reply did not ease the teachers' anxiety about money, materials, and technology. The result was an exclusion of the teachers' concerns about technology and materials in the "materials selection criteria."

The participants had the freedom to make decisions about their program, but external forces played a major role in the decision making processes of the participants in the group. The researchers believe that Martha was more concerned with her agenda than with the issues and concerns of the teachers. This was validated by the lack of specificity found in the "materials selection criteria" and in the agenda for the workshop.

During the initial three meetings between the researchers and the curriculum supervisor, ground rules were set as to the amount of influence the researchers were to give to the committee members. Martha, the curriculum supervisor stated that the presentation of the state and national standards was to be informative. She said, "You will not force this stuff on them. They need to decide for themselves." Even though the researchers were not allowed to influence a decision based upon the state and national standards, Martha was able to set her own agenda due to her

knowledge of the goals of the county and administrations. She stated that the committee "will meet with a certain goal in mind. We are a rural county and don't need to be keeping up with everyone else. We are fine the way we are." She went on to mention that science was not even a high priority at the moment in the county. It was important for the county to keep improving the reading and writing skills of the students. These skills had been lacking the past few years compared to state standards. Even though Martha had a priority and reason for her agenda, it was only shared with the researchers and not the committee members. Carla did mention that she believed students needed "to learn to read, so that they can read to learn later." An elementary teacher, Sandra, stated that "you have to know the alphabet before you can go on." Carla and Sandra agreed with Martha that reading was vital to understanding and doing science, but the other teachers were more concerned with science concepts, learning, inquiry, hands-on approach, and materials.

Discussion

Hadfield and Lillibridge (1991) stated that rural teachers have complained about not having hands-on materials and up-to-date scientific knowledge due to their professional isolation. In this study it was found that the teachers were isolated and had not heard of the new national and state standards which were considered up-to-date. The teachers in Olympic County also complained about the lack of materials and funding to obtain them.

Easton and King (1991) found that there was a heavy reliance upon textbooks and the "assign-study-recite-test" pattern of instruction which is opposite of what the national standards in education were promoting. The purpose of teaching science was to enable the students to understand the world around them so that they could act upon it. They found that all the teachers

in their study used the textbook. They found that 89% of the science teachers used publisher offered teacher manuals more than 50 days. The teachers in Olympic County used textbooks or publisher produced materials 60% of the time. Easton and King found that 11% and 22% of their teachers used hands-on materials more than 50 days and 10 to 50 days respectively. The percentage of teachers in Olympic County that used hands-on materials was 60% and 40% respectively. These results were determined through the survey and not through direct observation. It would seem that the teachers in Olympic County believed in and used certain salient ideas found in the national standards.

Some of the ideas found in the national and state standards were used and believed to be of importance for some of the teachers in Olympic County. The survey responses were given on a likert scale of 0 to 5 for knowledge of a particular idea; 0 being does not apply to me, and 5 being very confident in the knowledge of that particular idea. The Olympic County teachers were close to somewhat confident in their knowledge of cooperative learning. They were close to marginally confident in their knowledge of inquiry-based science lessons. The teachers were close to marginally confident in their knowledge of performance assessment. These results indicate that the rural teachers in this county did not know much about these three science teaching ideas found in the national and state documents.

It has been well documented that elementary teachers have lagged behind content specific teachers in acquisition of content and curriculum science knowledge (Dacus and Hutto, 1989). Dacus and Hutto (1989) stated that elementary teachers are usually hampered to increase science learning and improve science instruction by "inadequate training in science, lack of information on local natural history resources, and time and curriculum constraints (p. 1)." The elementary

teachers in Olympic county reflected these findings. Betty remarked that she needed "time and space for hands-on materials." Barbara replied that the "teachers do not have time to collect a lot of materials." Juanita was concerned about science knowledge and the integration of science with other disciplines; "reading and math are such time consuming subjects-I would like to know how to better tie these subjects into science."

Dacus and Hutto (1989) also found that the activities used by the teachers must follow mandated state's Department of Education and local curriculum committees. The regimented curriculum did not allow the teachers to deviate and make the curriculum appropriate for their students. The teachers in Olympic County believed that they had to follow the current state QCC guidelines. The teachers believed that their new curricula had to match the QCC. Mike was concerned about the lack of relevancy the QCC had to perceived good science teaching and learning. With the adoption of *GIMS* at the state level, his ideas for practical hands-on activities could flourish. Other teachers had reservations about new curricula if it did not directly relate to the QCC. "New textbooks should address most of the QCC objectives in a very direct way so that all science teachers can be sure that most of them are covered (Sandra)." Having the knowledge about the adoption of a more generalized and liberal set of standards, such as *GIMS* and *NSES*, would have allowed the committee members to have for freedom in their selection criteria.

Marshall (1987) stated that reform efforts must be directed toward lay persons with actual control over content (p. 1)." In this study the use of criteria was mandated by a state. In our study, a selection criteria was constructed based upon what the individual teachers felt were vital considerations for effective teaching. The external influence was the mandate from the curriculum supervisor. The implementation of national and state standards was an issue, but it was not as prominent as thought. The general ideas of good science teaching (inquiry, activities, hands-on

activities, discussion, and electronic media, including computers) were indirectly incorporated into the rating system of the "materials selection criteria." In other words the teachers knew what good science teaching and learning was and they would use that knowledge during their evaluation even though it was not found in written print on the "materials selection criteria."

Implications for science teacher education.

This paper emphasizes the need to disseminate the national and state standards on a more complete basis to rural schools. One method is to emphasize knowledge about national and state standards in preservice science methods classes. A second method of dissemination is to inform teachers during inservice workshops, departmental meetings, and faculty meetings.

Perhaps, if committee members are given more time to assimilate new concepts such as national and state standards into their thinking, they will have a greater likelihood of incorporating the new standards in their materials selection criteria. Or, if committee members are given free reign to construct their own materials criteria selection list, they might give greater emphasis to the new standards. Finally, if committee members are given more opportunity to learn new standards at an earlier stage in the materials selection criteria writing process and are given greater autonomy in writing the criteria, then the chances of including the standards in the final product may improve. Although we did not have the opportunity to study the committee under the foregoing circumstances, it would seem to be a profitable area for further research. Another area for future research would be to conduct a longitudinal study of the effects of the new curriculum on the teachers and students. A second part would be to monitor the amount of implementation of national and state standards' concepts as a result of the new curriculum materials being used.

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Appendix A

Science Textbook Evaluation Criteria

Series Title/Level: Evaluator:

Publisher:

Circle the appropriate number next to each criterion as applicable.

On the following scale, 1 = total disagreement and 4 = total agreement.

GRADE APPROPRIATE FOR STUDENTS	1	2	3	4
• readability				
• grade appropriate activities				
• adapted for low - high achievers				
USER FRIENDLY FOR TEACHERS	1	2	3	4
• organized to easily use TE and student book				
• supplementals easy to use				
• appropriate charts, diagrams				
CONTENT ALIGNMENT	1	2	3	4
• national standards				
• QCC				
• GIMS - state adopted learning framework				
• current issues - up to date				
• topics are covered in depth				

PROCESS APPROACH 1 2 3 4

- labs well integrated, high quality
- problem solving approach
- hands-on activities throughout
- inquiry/discovery process (vs. Cookbook labs)
- technology integrated well
- higher order thinking

ASSESSMENT 1 2 3 4

- formative assessments in book so students can test themselves
- variety of test formats
- skills assessment as well as content assessment
- project assessments
- parallel structure with graduation test and CBA's

SUPPLEMENTAL MATERIALS (FREEBIES) 1 2 3 4

- enrichment
- study helps
- tests
- is it worthwhile
- can I teach without it?
- labs
- updates
- remediation support

ORGANIZATION 1 2 3 4

- logical - presentation
- AV
- can you re-sequence
- refernece sections easy to use
- easy for low students to follow

OTHER CONCERNS

TOTAL SCORE